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Characterisation of Infantry Section and Platoon Activities

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Wayne S. R. Hobbs

DEPARTMENT OF DEFENCE
DEFENCE SCIENCE AND TECHNOLOGY ORGANISATION

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ABSTRACT

This paper describes the formulation of a list of activities that can be used in analysis of infantry operations. Company tasks have been used to derive nine distinct activities that may be carried out by infantry sections and platoons. These were characterised in terms of the separate phases, skills and tools required, physiological and psychological intensity and proposed analytical measures. Six core skills were identified that are common to several activities. Personal factors related to non-combat time were also determined. Taken in total, the personal factors, and the section and platoon activities are sufficient to adequately categorise the "soldier's day". The work supports soldier modernisation studies as part of Project WUNDURRA.

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Characterisation of Infantry Section and Platoon Activities

Executive Summary

In this paper, a logical sequence has been followed to propose nine outcome based section and platoon activities derived from the company tasks described in doctrine. The nine activities are: "orders", "patrol", "attack", "ambush", "defend", "vehicle check point", "observation post", "tactical movement" and "occupy harbour". These have been characterised in terms of the phases of the action, skills and tools used, and physiological and psychological consequences and demands. Additionally, a procedure has been developed, based on likely events, to propose possible measures of effectiveness (single aspects of the activity) and measures of outcome (a combination of single aspects, including positive, negative and value adding aspects).

A series of five personal factors has been proposed to complement these combat activities: "waiting", "sleep", "eating/drinking", "rest" and "personal hygiene".

The combat activities demand competency in core areas, and these were derived from a consideration of the common skills needed to carry out the activities. Six core skills were identified: "communication", "navigation", "surveillance", "engagement", "movement" and "protection". Enhanced competence in these areas, through the insertion of technology or changes to procedure will lead to increased capability to perform the combat activities, and would be manifest in the analytical measures. To some extent the personal factors can also be counted as core skills since they may also increase the effectiveness of combat activities and are the subject of investigation for possible technology insertion.

Strict taxonomy has not been adhered to, since it is recognised that boundaries between the different activities, core skills and personal factors are not well defined. However, each term is distinct, though not exclusive, and represents a pragmatic approach in keeping with the desired goal of usefulness to the analyst and the Army client. Taken together, the combat activities and personal factors are sufficient to adequately identify the "soldier's day" and have been successfully applied to a platoon analysed during KANGAROO 95.

Analysis of small units through activities and core skills has formed the basis of the field experiments and modelling conducted to support Project WUNDURRA. This approach has greatly assisted in the development of a sound methodology in a previously immature area with the result that analysis of small dismounted units can now be attempted and useful results obtained. For instance, studies of the effect of technological enhancement of "attack", "ambush", "defend", "patrol" and "observation post" activities have been used to support the development and progress of the WUNDURRA concept for the Committee process.

Authors

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Neville Curtis obtained his PhD in Chemistry at the University of Alberta in 1981 and undertook post-doctoral research as a Research Fellow at the Research School of Chemistry, Australian National University. He joined DSTO in 1984. After initially researching aspects of gun propellants, in particular stability, he moved into Operations Research studies of weapons systems. He spent 15 months in DSTO Central Office in support of the Program Improvement during 1992-3. He returned to Salisbury in 1994 and is currently a Senior Research Scientist with Land Operations Branch.

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1. Introduction

Analytical support to combat soldier modernisation, as part of Project WUNDURRA, may be considered from several directions [1]. One approach is to delineate specific activities that make up the soldier's overall capability, and to analyse or investigate each in turn. Whilst this may not lead to identification of synergisms or antagonisms in the overall system, it at least allows detailed examination of manageable parts of the system. In this context, individual activities [1] are convenient items for analysis through modelling and field experimentation, and can be used as a vehicle for determination of the value of technology products that may enhance capability.

Project WUNDURRA is concerned with the capability of the small unit, as a constituent of a company, of which the individual soldier is a building block. It is directed towards the combat soldier in general, though initial work has concentrated on Infantry, in order to properly develop concepts before extension to other Corps. In this paper, we determine an initial list of activities of the infantry soldier, pitched at the small unit (section or platoon) level. Specific items include:

a) the goals of modelling and activity analysis,
b) a method of developing a list of activities both for sections or platoons, and for individual soldiers,
c) the derived activities in detail, and
d) analytical measures.

The term "activity" is hard to define. In this paper, we have taken it to mean a discrete part of the soldier's or unit's function that is a set action with an identifiable outcome. Such activities must be set at such a level that they are neither too specific nor too generic, in order to be useful to the Defence analyst. It must also be a meaningful and familiar constituent of Army procedure. Finally, it should be something that, though multidisciplinary, can be described in some way, be it qualitative or quantitative. In particular, we wish to cast activities in such a form that they can be amenable to semiquantitative or quantitative analysis, either through wargames or other modelling or simulation. This appreciation dictates a pragmatic rather than strict taxonomic approach and the emphasis is on the formulation of useful "activities".

2. Soldier Combat System Modelling

2.1 Goals of modelling

The force development process comprises the analysis of existing or projected capabilities that may lead to recommendations of materiel acquisition. Analysis of the effectiveness of small units containing "enhanced soldiers" is however far from mature. Tools need to be developed, many parameters are not yet known and appropriate analytical measures need to be justified and tested. Importantly, the subject requires ways to predict the effect of technology insertion or changes in procedure, and means of identifying the critical points that will respond to enhancement. One solution is the derivation of a series of standardised activities, that will allow:

a) a basis from which specific operational situations can be developed
b) deconstruction into constituent parts to allow identification of critical steps
c) characterisation of the activity to identify skills or tools usage
d) measurement of effectiveness of a unit:
   - baseline capability
   - the effect of equipment improvement
   - the effect of procedural improvement
e) parametric analysis to determine equipment requirements

Importantly, equipment in a range of accessibility can be tested through modelling: that currently held, currently available, near to available or merely represented as a concept with no physical substance. Combined with the activity deconstruction this approach allows for determination of goal characteristics of equipment in development. This can be used to determine a useful limit to performance above which no change is found to overall effectiveness, or it can identify critical threshold values that may themselves represent "quantum" leaps in capability. Such models should always be verified, where possible, through a sequence of:

a) model,
b) test in field experiment, and
c) revise model.

Finally, it should be noted that the thrust of this paper is directed towards the small unit combat system. To some extent this is a different approach to other soldier modernisation programs around the world that concentrate on the soldier combat system (SCS). There is however still a need to look at the individual and areas where this could be implemented are noted in the text.

2.2 Available wargaming modelling tools

DSTO holds three wargaming models or simulations that could be applicable to analysis of the future fighting soldier activities:

a) JANUS,
b) CAEN (Close Action ENvironment) and
c) IUSS (Integrated Unit Simulation System).

These wargame models contain algorithms that address certain features of an operation (eg target acquisition, movement, casualties etc) in an integrated manner, though the level and scope vary. The JANUS wargame has insufficient resolution for studying individual soldiers, at least in a study on ambushes [4]. CAEN and IUSS however, have been designed specifically for studies at the small unit level (section group, section or platoon), and are the models of choice though both are far from mature and will be further developed to include more features. In particular, human factors terms related to the longer term, low intensity conflicts in Australia's north are not well catered for. Despite these deficiencies, CAEN and IUSS are the best currently available, and any activity analysis can usefully make full use of them. Analysis should however not be restricted by the current wargaming capability especially when their immaturity is considered.

DSTO studies have concentrated on the application of CAEN because it is well suited to modelling activities that involve contact with an adversary. It can also be used to study out-of-contact activities, such as patrolling, however, in some instances it is more appropriate to use non-interactive models for this purpose. The major benefit of the CAEN wargame is its use of pre-defined "activities" linked to tactical "triggers". Hence for specific triggers, such as a shot being heard or sighting of the enemy, the soldiers will perform a predefined set of actions. The activities of infantry soldiers need to be examined in sufficient detail to provide the information necessary to program the CAEN wargame with the appropriate tactical triggers and corresponding responses or drills. Before attempts at collecting detailed data are made, the applicability and limitations of CAEN need to be appraised. Hence, an outcome of compiling a list of soldier activities is to determine which tools will be used to study specific activities and to ensure that all relevant aspects of the soldier or section combat system are being studied. An overemphasis on wargame analysis may leave important activities like receiving and processing orders being given less attention than they deserve.

3. Generation of Section and Platoon Activities

3.1 Strategic guidance

The small unit combat system should include not only the soldier and equipment, but also the environment and the enemy. Hence analysis will be dependent on the allocation of suitable scenarios in which these parameters are defined, and these need to be determined in view of strategic guidance and the potential roles of the combat soldier within these guidelines. Strategic Review 1993, lists the key roles for the ADF in the defence of Australia. The pertinent roles for this study comprise:

a) surveillance of maritime areas and northern Australia,
b) defeat of incursions on Australian territory, and
c) protection of important civil and defence assets.

More recently a review of Army capability in the 21st century (Army 21) has identified a list of five operational dimensions[1]:

a) detect,
b) protect,
c) respond,
d) inform, and
e) sustain.

All soldiers will contribute to each of these to a greater or lesser extent, with the infantry soldier applied mostly to detect, protect and respond. Indeed the tenets of Project WUNDURRA can be proposed to cut across these three areas and separate considerations against the individual dimensions seem inappropriate at this stage. In addition, it is likely that the activities of the individual soldier in a section or platoon will be largely independent of the role in which the battalion is being deployed. For instance, battalion strategic or operational capability will be effected through company tasking with possible subsequent deployment of a platoon or section.

Combat soldiers, whether specifically called "infantry" or not, will still be required to patrol, to seize ground and to close with and destroy the enemy, irrespective of any changes in organisation which may occur in the future. The relative importance of these activities may vary of course, but the activities and their analysis, will be relatively consistent across all the roles.

[1] No priority is implied in this order

3.2 Company tasks

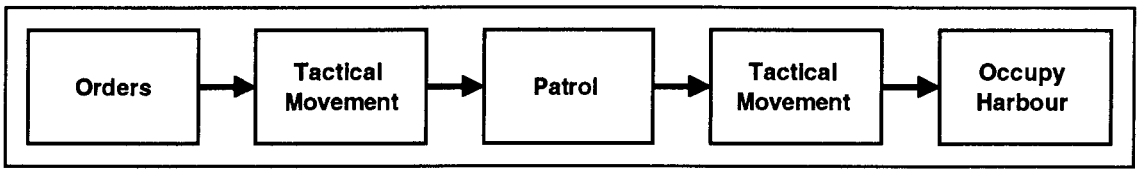
The Army 21 operational dimensions are directed towards outcomes and capabilities, with no inference as to the methods employed by the Infantry to provide these capabilities. A convenient route to derive a list of combat soldier activities is through company level doctrine. The rifle company is capable of undertaking seven tasks [5,6]:

a) seize and hold ground,
b) destroy or capture enemy by fire and movement,
c) provide a firm base for other elements of the battalion,
d) patrol,
e) provide protection for the battalion during advance and withdrawal,
f) provide a force to operate independently for short periods on special tasks, and
g) conduct air mobile or mounted operations if required.

The relative importance of each of these tasks will vary depending on the overall objectives of the battalion. However the construction of a list of infantry activities based on these company tasks will be relatively independent of Strategic Guidance. Strategic Guidance will however set values for many of the parameters used in the analysis of the combat soldier, such as adversary strengths and environmental considerations.

3.3 Section and platoon activities

Functional deconstruction of each company task can be used to determine significant activities at the section or platoon level, as follows for the example of the patrol task:



A similar process for the other company tasks gives a list of small unit activities as in Table 1. These are fundamental procedures that will respond to external influences such as technology insertion, doctrinal change and local conditions. These activities may be performed independently or in conjunction with other units. Hence the "attack" activity ranges from section quick attacks to a full company attack.

Table 1: Company and "Small Unit" tasks

Company Task	*Section or Platoon Activity*
Seize and hold ground	orders, attack, tactical move, patrol, defend, occupy harbour
Destroy/capture enemy	orders, attack, ambush, patrol
Provide firm base	orders, occupy harbour, patrol, vehicle check point, observation post
Patrolling	orders, tactical move, patrol, occupy harbour
Provide protection	orders, patrol, observation post, defend, occupy harbour
Provide independent force	orders, attack, patrol, observation post, tactical move
Conduct air-mobile operations	orders, tactical move, attack, patrol

Several of the section and platoon activities are common to several company tasks, and nine core small unit activities can be derived (in no particular order), as below:

a) orders,
b) patrol,
c) attack,
d) ambush,
e) defend,
f) vehicle check point,
g) observation post,
h) tactical movement, and
i) occupy harbour.

4. Characteristics of Section and Platoon Activities

4.1 Introduction

The section or platoon activity represents an outcome based feature that can form the basis of analysis of the effectiveness of the soldier combat system. The activities are at an appropriate level at which meaningful analytical measures can be assigned and the impact of changes in the capability of individual soldiers assessed. These capability enhancements are primarily achieved through improvements in technology that are manifest in the tools and core skills possessed by the individual soldiers. It is of course still important to identify which process is being enhanced by the improved technology, and in some cases it is critical to perform the analysis such that specific parts of the activity can be addressed. For this reason it is appropriate to further divide the section or platoon activities into phases and constituents, but only as an analytical convenience. There is little value in performing a sequential degradation into a long list of specific parts. There is value however in understanding each of the core skills in order to better represent the action in the computer model.

The purpose of this section is to examine each section or platoon activity in more

detail, specifically to characterise each activity in terms of:

a) a description of the phases or constituents,
b) skills and tools required,
c) physiological or psychological effort, and
d) analytical measures

The last term can be further delineated into four levels of a hierarchy (Table 2), though only two will be considered in this paper: measures of effectiveness and measures of outcome, and representative examples are given in Figures 1 to 9. Measures of performance relate to specific functions, and whilst they are critical as input parameters for modelling, they are not at the same analytical level as the activity, though contribute to the measures of effectiveness. Conversely, measures of capability are at too high a level and refer to combinations of several activities. Measures of effectiveness and outcome however are directly relevant and form the basis of modelling studies. The difference between the two can be readily explained as: measures of effectiveness are defined by a single aspect of the activity, whilst measures of outcome comprise a combination.

Table 2: Hierarchy of analytical measures

	measure	**level**	**examples**
MOP	performance	specific function	detection range
MOE	effectiveness	a single aspect of the activity	loss exchange ratio
MOO	outcome	an overall perspective of the activity	ability to achieve a task within a range of constraints
MOC	capability	an integration of all activities to quantify a higher level objective	ability of a company to contribute to the "protect" operational dimension

A simple method of generating analytical measures through a process of identification of possible events has been used in this paper. Some events are unlikely, such as complete destruction of one side or the other, but are used to generate useful quantitative comparisons, such as loss exchange ratios. There are several measures of effectiveness for each activity. Several of these activities are currently being studied in detail [7,8], with analysis of the likely effects of potential technology insertions. In particular, the values and sensitivities of appropriate measures of effectiveness are being considered in detail. It is also apposite to note that any analysis of a single activity is fraught with danger and attention must be paid to the overall consequences of any materiel or procedural solution. Any combination of measures of effectiveness involved in the activity will inevitably lead to trade-offs between positive and negative factors. A simple example is of a patrol where calculations may be made of the area covered at a certain detection probability. This is of course of little use if the red forces sight the blue forces first and evade detection. A useful measure of outcome would include both terms: the area where the blue forces will be *able to detect* the red forces

(and set at a particular detection probability). Finally there are also value adding factors that increase the worth of the victory in terms of the overall campaign.

This approach is not taxonomic since these activities are interrelated and in any case strict adherence to exclusivity seems unimportant. Indeed, overlap does occur between activities and this should be seen as positive and avoids any omissions. Extra company tasks can be easily incorporated into this analysis if required, though it is likely that most can be analysed in terms of combinations of the activities already identified. Finally, it should be noted that section is indicative only with Figures 1 to 9 intended to give examples rather than a comprehensive list. For the purposes of this paper, early 1996 has been taken as the technology baseline.

4.2 Characterisation of individual activities

4.2.1 Orders

An initial task in any procedure is the conduct of "battle procedures" of which the major constituent is "orders". This activity includes all actions associated with the receipt, processing and passing on of orders. Orders are an implicit part of the command and control sequence, and may range in scope from "brief" to "complete" dependent on time constraints. It comprises (repeated at company, platoon & section levels) :

- receiving orders
- analysing orders
- preparing orders
- giving orders

<table>
<tr><td colspan="2">Skills and tools</td><td colspan="2">Physiological & psychological implications</td></tr>
<tr><td colspan="2">- communication (pen & paper, word of mouth, vue tue)
- navigation (maps & diagrams)
- self planning aids (as above)</td><td colspan="2">Low physical exertion but much time consuming mental activity, especially with contingency planning</td></tr>
<tr><td colspan="2">Event</td><td colspan="2">Measure of effectiveness</td></tr>
<tr><td colspan="2">orders passed from company commander to platoon commander</td><td colspan="2">travelling time, scope of intelligence, value to overall decision making, analysis required</td></tr>
<tr><td colspan="2">orders passed from platoon commander to section commander</td><td colspan="2">scope of intelligence, effect on communication and morale, time taken to prepare orders</td></tr>
<tr><td colspan="2">orders passed from section commander to section</td><td colspan="2">scope of intelligence, effect on communication and morale, time taken to prepare orders</td></tr>
<tr><td>Positive factors</td><td>Negative factors</td><td>Value adding factors</td><td>Measures of outcome</td></tr>
<tr><td>information transferred, better communication</td><td>time taken for travel, contingency planning</td><td>timeliness, completeness, lack of redundancy</td><td>effective passage of useful information in a timely manner</td></tr>
</table>

Figure 1: Characteristics of "Orders"

4.2.2 Patrol

A major requirement of the infantry is to conduct patrols either to find enemy or to deny use of land. Patrolling will either be conducted directly from a secure harbour, on foot, or conducted after transport to a patrol location. Obstacles may be encountered as part of a patrol and these should be treated in terms of "occupy harbour". "Patrol" comprises:

- battle procedures
- start patrol
- the patrol itself
    - adopt formation
    - move
    - scan arcs
    - check navigation

    (repeated through patrol)
- end patrol
- movement out of patrol area
- debrief

<table>
<tr><td colspan="2">Skills and tools</td><td colspan="2">Physiological & psychological implications</td></tr>
<tr><td colspan="2">- navigation (map & visual landmarks, GPS)
- patrol movement (foot or vehicle)
- communications (intrasection & intraplatoon field signals, radio links from platoon to company)
- surveillance (based on the human senses of sight, sound & smell, though night vision devices are being introduced)</td><td colspan="2">In the majority of cases patrolling will be conducted in "patrol order" (ie weapon & webbing without large pack), & the level of physical effort will be dependent on: load carried, terrain & going, environmental conditions and duration of patrol. Mental requirements may be intense in situations where contact with the enemy is likely or if the patrol wishes to remain undetected.</td></tr>
<tr><td colspan="2">Event</td><td colspan="2">Measure of effectiveness</td></tr>
<tr><td colspan="2">blue force achieves a point in a sequence comprising: does not detect the enemy, detects but does not identify, or identifies the enemy</td><td colspan="2">area covered per unit time at a certain level of detection (or identification) of the red forces</td></tr>
<tr><td colspan="2">blue force denies use of ground to the red force</td><td colspan="2">denial (time and area) of the search zone to red forces</td></tr>
<tr><td colspan="2">red force detects blue forces</td><td colspan="2">probability of detection by the red forces</td></tr>
<tr><td>Positive factors</td><td>Negative factors</td><td>Value adding factors</td><td>Measures of outcome</td></tr>
<tr><td>area covered</td><td>risk of being seen</td><td>denial of area</td><td>area where the blue forces will be able to detect the red forces</td></tr>
</table>

Figure 2: Characteristics of "Patrol"

4.2.3 Attack

The "attack" activity includes all assaults on enemy personnel, except ambushes and defence of harbour positions, from quick section attacks through to platoon and

company level deliberate attacks. The stages of the "attack" are relatively similar in all instances with varying time and effort placed on different stages due to the increased level of coordination between different elements of a force. The sequence may vary depending on whether it is a deliberate (ie where time is sufficient for complete planning and equipment) or quick attack (in response to a contact), and whether blue or red forces make the first detection. A quick attack covers first contact with the enemy through to reorganisation, whereas the deliberate attack will cover from the onset of fire support or movement out of the form-up point. "Attack" comprises:

- battle procedures
- contact
- manoeuvre
- firepower projected towards enemy
- fire and movement or fight through
- reorganisation
- report
- manoeuvre

<table>
<tr><th colspan="2">Skills and tools</th><th colspan="2">Physiological & psychological implications</th></tr>
<tr><td colspan="2">- communications (currently voice & field signals)
- navigation (knowledge of local conditions)
- engagement (includes generic weapons both for destructive & neutralising effect, & also special obscurant or blinding devices)
- movement</td><td colspan="2">Human factors, particularly morale, play a key role in the success of any engagement, particularly where the perceived threat of personal injury is high. "Attack" is both a highly mentally & physically demanding activity, though may be of short duration.</td></tr>
<tr><th colspan="2">Event</th><th colspan="2">Measure of effectiveness</th></tr>
<tr><td colspan="2">red force receives sufficient casualties, depletes resources or becomes outmanoeuvred & withdraws or surrenders</td><td colspan="2">loss exchange ratio, time taken, resources used, number of civilian or blue on blue casualties</td></tr>
<tr><td colspan="2">blue force receives sufficient casualties or depletes resources and breaks off the attack</td><td colspan="2">loss exchange ratio, time red force occupied and resources used</td></tr>
<tr><td colspan="2">red force is completely destroyed</td><td colspan="2">loss exchange ratio, time taken, resources used and number of civilian and blue on blue casualties</td></tr>
<tr><th>Positive factors</th><th>Negative factors</th><th>Value adding factors</th><th>Measures of outcome</th></tr>
<tr><td>red losses</td><td>blue and neutral losses</td><td>morale boost of low cost victory (and vice versa)</td><td>losses experienced by the blue force when red forces are in a position where they must withdraw or surrender</td></tr>
</table>

Figure 3: Characteristics of "Attack"

4.2.4 Ambush

This will be handled separately from an attack as there are distinct differences between the two activities, owing to:

a) the covert nature of ambushes,
b) the preparation of ambush locations (flares, Claymores, staked guns etc.), and

c) ambush engagements are "static" (rather than involving fire and movement).

The "ambush" activity is considered to cover the period after movement into the ambush location up until withdrawal from that location including any casualty evacuations. It comprises:

- battle procedures
- selection of ambush site
- positioning of groups
- setting of devices
- wait for enemy to appear in ambush site (usually at night)
- positive enemy identification
- set off devices & weapons
- search bodies for equipment and intelligence/information
- debrief
- movement from ambush site

<table>
<tr><td colspan="2">Skills and tools</td><td colspan="2">Physiological & psychological implications</td></tr>
<tr><td colspan="2">- communications (currently field signals or whispers)
- surveillance (difficult at night though better with night vision devices)
- engagement (generic weapons and special devices such as trip flares, Claymores.)
- protection (effective use of vegetation and terrain for concealment)</td><td colspan="2">It is a highly mentally intensive activity, often requiring attention over several hours. Target identification is difficult, particularly at night. The ambush itself is not physically demanding though troops must remain in a fixed position for extended periods & this may present problems if followed by vigorous activity.</td></tr>
<tr><td colspan="2">Event</td><td colspan="2">Measure of effectiveness</td></tr>
<tr><td colspan="2">ambush occurs with no return fire from the red forces</td><td colspan="2">time available for decision making, area of killing zone, time to conduct examination, timeliness and accuracy of report to higher echelon, resources used</td></tr>
<tr><td colspan="2">red force survives initial volley and either fights back or escapes</td><td colspan="2">loss exchange ratios, resources used</td></tr>
<tr><td>Positive factors</td><td>Negative factors</td><td>Value adding factors</td><td>Measures of outcome</td></tr>
<tr><td>red losses, information gained</td><td>blue or neutral losses, red force is alerted and does not enter ambush</td><td>no return volley</td><td>probability of destruction of enemy with no blue force loss</td></tr>
</table>

Figure 4: Characteristics of "Ambush"

4.2.5 Defend

Harbours may need to be defended to protect the occupants or to cover other units to withdraw. From an analytical point of view, it is similar to some extent to the "attack" activity, though distinct measures of effectiveness need to be applied. It comprises:

- battle procedures
- contact

- firepower projected towards enemy
- battlefield movement
- reorganisation
- analysis
- report
- manoeuvre

Skills and tools		**Physiological & psychological implications**	
- communications (currently voice & field signals) - navigation (knowledge of local conditions) - engagement (includes generic weapons both for destructive & neutralising effect, & obscurant or blinding devices) - movement - protection (earthwork, natural features or buildings)		Troops would not normally be carrying backpacks, would have fewer restrictions on ammunition usage (with resupply from a cache) & may have access to company or battalion deployed firepower. Little movement would be required & thus the actions would be of medium physical exertion but high mental requirements.	
Event		**Measure of effectiveness**	
blue position overrun, blue force receives sufficient casualties, depletes resources or is outmanoeuvred and withdraws or surrenders		loss exchange ratio, time taken, resources used	
red force sustains enough casualties or depletes resources to break off attack		loss exchange ratio, time taken, resources used	
blue force is completely destroyed		loss exchange ratio, time taken, resources used	
Positive factors	**Negative factors**	**Value adding factors**	**Measures of outcome**
red losses	blue losses	time enemy held up	the ratio of blue forces to red forces to achieve victory

Figure 5: Characteristics of "Defend"

4.2.6 Vehicle Check Point (VCP)

This can be considered as a specialised type of harbour defence, though there are sufficient differences to merit a separate category. The vehicle check point is inherently a policing activity that must be backed by sufficient visible force. Interaction with the civil community is an important aspect of the VCP. It comprises:

- battle procedures
- occupy VCP location
- position inspecting units
- position support units
- carry out VCP
    - halt traffic
    - question travellers
    - inspect vehicles
    (repeated through VCP)
- delocate from VCP
- report

Skills and tools		Physiological & psychological implications	
- surveillance (currently physical senses, which may be enhanced by unmanned sensors & night vision devices to warn of oncoming traffic) - communications (word of mouth between the inspecting units & support, or radio between the VCP & higher echelon - protection (for support unit - earthworks or vegetation)		There are no outstanding human factors implications other than the need to stay alert.	
Event		**Measure of effectiveness**	
red force is deterred from using the choke point		percentage of red force vehicles that would not attempt to go through the choke point	
blue force achieves a point in a sequence comprising: detection of incoming traffic, identification of vehicles, vehicle stopped, personnel and vehicle assessed, and suspects detained		percentage of suspect vehicles stopped, effectiveness of inspection (percentage of enemy vehicles unknowingly allowed through)	
Positive factors	**Negative factors**	**Value adding factors**	**Measures of outcome**
vehicles successfully searched	red force retaliation, inspection not effective	denial of choke point	percentage of red force vehicles that go through choke point

Figure 6: Characteristics of "Vehicle Check Point"

4.2.7 Observation Post (OP)

This can also be considered as a specialist type of harbour position. In this case the harbour is covert with the objective of observing enemy movements in a specific location. The principal output of the observation post is intelligence or information and contact with the enemy would be rare except in extreme circumstances where a fleeting target of opportunity existed. A section in an OP will usually operate on a roster with two soldiers engaged in surveillance whilst the remainder will occupy a harbour to the rear of the OP site. An OP activity covers the period from movement into the OP through to vacating of the OP site & may last for several days. It comprises:

- battle procedures
- occupy OP
- position surveillance devices
- carry out surveillance
- remain covert (a continuing function)
- analyse sightings
- report sightings
- delocate from OP
- report

Skills and tools		Physiological & psychological implications	
- surveillance (physical senses that may be assisted by night vision devices or unmanned surveillance units) - communications (currently limited to field signals, K-phone or verbal communications between the exposed & covering troops, or radio link to a higher echelon, otherwise information is collected & relayed upon return to base unit) - navigation (position of red force actions)		It will be a mentally draining activity regardless of sightings or contact with the enemy	
Event		**Measure of effectiveness**	
a progression of activity from detection of movement, identification of troops or vehicle, identification of actions and passage of information to higher echelons		area covered at certain levels of detection or identification, probability of detection of the OP, information gathered, information passed on, ability to attack a target of opportunity	
blue force denies area to red force		area and time of denial to red force	
Positive factors	**Negative factors**	**Value adding factors**	**Measures of outcome**
information gained	late transfer of information	timeliness for response	value of information transferred to higher echelon

Figure 7: Characteristics of "Observation Post"

4.2.8 Tactical movement

For the purposes of this paper, this is defined as any movement around the tactical area of responsibility (TAOR) that is not patrolling, or an integral part of an activity such as movement away from an ambush. Patrolling may be used for tactical movement, but this would not vary in characteristics from the standard patrolling task except that in some cases packs may be carried. Tactical movement is an activity that will be completed prior to and after the completion of many of the other activities detailed in this section. Phases have not been identified though trivial items such as entering and leaving the transport could be identified.

Skills and tools		Physiological & psychological implications	
- personnel may move around the tactical area by rotary wing aircraft, armoured personnel carrier (APC), light armoured vehicle (LAV), other light vehicle or on foot		Whilst little mental exertion is required, the trips can be tiring, particularly over unfavourable ground or in adverse weather conditions.	
Event		**Measure of effectiveness**	
fatigued troops		fatigue experienced, the use of resources (principally water), time taken, exposure to possible danger	
new position reached		accuracy of the movement in terms of location and time	
Positive factors	**Negative factors**	**Value adding factors**	**Measures of outcome**
achievement of position	fatigue of troops	timeliness	time taken to be ready for next action

Figure 8: Characteristics of "Tactical movement"

4.2.9 Occupy harbour

Any new location for the section or platoon must be secured irrespective of the period of time that the unit will spend in that location. Occupation of the harbour is listed as a separate activity although it may form an integral part of other activities particularly "defend". This may be as simple as an "all round defence" while a section pauses during a patrol, through to the occupation and construction of a complex battalion defence. In any situation where the section may be overly vulnerable due to its activities it will adopt some form of protective configuration. The procedure for movement into and out of these defensive postures will depend on the degree of protection or stealth required. Initial occupation of the harbour may take from several minutes to several hours depending on the type of harbour. Defensive harbours of one form or another are used during:

a) obstacle crossing,
b) occupation of an OP,
c) occupation of a VCP,
d) rest breaks on a patrol,
e) protection of assets, and
f) provision of a firm base.

Skills and tools		**Physiological & psychological implications**	
- set tactical procedures dictated by doctrine - protection (construction of defences, or use of terrain or vegetation)		Will be of varying physical activity depending if manual labour is involved in preparing fortifications	
Event		**Measure of effectiveness**	
harbour successfully occupied		number of troops required (a consequence of intelligence and planning), area protected, time taken to provide cover, risk in departure, number of troops not required for defence	
harbour aborted		adequacy of planning information	
Positive factors	**Negative factors**	**Value adding factors**	**Measures of outcome**
troops in position, use made of position	inadequacy of planning information, exposure to assault or surveillance	safe & secure area, short time for achievement	potential use of secured area by local commander

Figure 9: Characteristics of "Occupy harbour"

5. Individual Core Skills

5.1 Introduction

In section 4, the section and platoon activities were broken down into constituent actions. Whilst this process may be continued to ever smaller events, this is unlikely to be a fruitful exercise owing to the likely large set and its dubious value. In particular, the common threads will be difficult to identify. An alternative to this hierarchical procedure is the derivation of generic core skills. These may be characterised as skills that are used on many occasions, and that add value to the capability of soldiers to perform tasks. The analysis in section 4 identified six of these common skills, in addition to actions dictated by doctrine, and these may be considered at both the individual and small unit levels:

a) communication,
b) navigation,
c) surveillance,
d) engagement,
e) protection, and
f) movement.

Core skills may be characterised (Figures 10 to 15) according to the following features:

a) description,
b) tools,
c) physical and mental effort, and
d) possible technology products and possible enhancements to section and platoon activities.

For the last topic, the technology examples given are all currently available or are close to being available, and have been trialed recently in the Infantry Technology Evaluation Study [3] or planned for future experiments. The proposed enhancements will require experimental verification and should be investigated for synergism and antagonism. In this paper, likely enhancements for specific activities are highlighted. These aspects will be the subject of reports on the outcomes of these experiments.

Scope exists to extend the list of core skills as the nature of the battlefield evolves. For instance, several of these skills relate to the gathering and relay of intelligence or information, though this is not treated as a separate skill in this paper.

5.2 Characterisation of core skills and possible technological enhancements

5.2.1 Communication

This is the means of transferring information, and two aspects are relevant to this discussion:

a) vertical communications (soldier to section commander to platoon commander to company HQ), and
b) intrasection and intraplatoon communications.

Noise, range and visibility constraints are the principal influences on non-electronic communications at present. Current tools include field signals, verbal interactions, K-phones and radio (platoon level only).

Physiological & psychological implications	Possible technology enhancements	Examples of enhanced activities
Communication has low physical effort but requires varying levels of mental activity, particularly if complex data is passed or if other stimuli are present	intrasection radios	- patrol: less time watching for field signals, larger spacing between soldiers, more area covered - attack: better control, higher optempo - ambush: better layout, more time for decision making - defend: better control, higher optempo - occupy harbour: more efficient action - orders: real time instructions
	digital transmission	- orders: more flexibility in type of data transmitted

Figure 10: Characteristics of "Communication" and possible technological enhancements

5.2.2 Navigation

In this context this refers to finding the position of units. This may be at the macro level in the movement from one site to another, or may reflect micronavigation, for instance, the precise location of members of a section during combat. Of great importance, though difficult to quantify, is the need for adequate fieldcraft and familiarity with the environment. Land homogeneity and lack of reliable landmarks are the principal problems to the use of maps in some areas. Current tools are limited to map and compasses though some units may have access to a global positioning system (GPS) unit.

Physiological & psychological implications	Possible technology enhancements	Examples of enhanced activities
Navigation has low physical intensity but requires some mental effort. In all cases a map will be used, regardless of the source of the directions or orders & the means of positional identification.	- man-portable carried computer containing a GPS with coarse resolution (to ±150m)	- tactical movement: automatic route mapping, less errors - patrol: more efficient coverage of area - attack: more effective use of the land - orders: higher commander knows position of forces
	- a similar device though giving fine resolution (to ± 5)	- attack: better situational awareness, positional intelligence - defend: positional intelligence - orders: targeted to individuals rather than broadcast to the whole section or platoon

Figure 11: Characteristics of "Navigation" and possible technological enhancements

5.2.3 Surveillance

This is a core skill related to watching, looking and finding either physical presence of enemy forces, or signs that they have been in the area. For the purposes of this paper, surveillance when treated as part of a weapon system has been included in the "engagement" section. Conventionally, three aspects are considered for physical surveillance:

a) detection,
b) recognition and
c) identification.

All have important positions in soldier activity. Detection may be restricted by unfavourable terrain and vegetation, and operations at night.

A change may occur in the battlefield with increasing usage of ESM, thus necessitating differentiation of physical surveillance of presence from surveillance of ESM usage. There are no current tools or procedures. Possible problems would lie with signal recognition and short term analysis of the content or direction of the signals. Two likely components would be:

a) detect communications, and
b) detect electronic device usage.

Finally, signs are an important part of patrolling and intelligence gathering in general. Typical signs would be footprints or disturbed soil or vegetation. Infrared techniques may be useful in detection of these signs, though it is probable that direct observation of a footprint will be the only realistic method of detection for the foreseeable future. The problem then becomes one of mobility and efficient ground

surveillance. Current skills are limited to the physical senses though may be enhanced by binoculars or other devices. Night vision equipment is currently being acquired as part of Project NINOX.

Physiological & psychological implications	Possible technology enhancements	Examples of enhanced activities
Surveillance involves high mental activity though physical exertion depends on the accompanying combat procedure. The mental intensity results in problems in maintenance of alertness &whilst this may be cured by effective rostering, movement detectors & pattern recognition may be available at the individual level.	- unmanned sensors	- attack: better planning - VCP: alert for incoming traffic - OP: more area covered, higher accuracy, alert for incoming traffic - orders: better tasking
	- infra red (thermal) detection	- patrol: better detection of presence or activity - VCP: alert for incoming traffic - OP: alternative data source: higher information content - occupy harbour: more efficient action
	- directional microphone	- patrol: extends detection range - VCP: alert for incoming traffic - OP: increased alert range - occupy harbour: more efficient action
	- low light level night vision devices	- patrol: better spacing between soldiers, better detection range - attack: better range for target detection & recognition - ambush: better range for recognition, more time to initiate action - defend: better range for target detection & recognition - VCP: better cover of exposed troops - OP: better coverage, more accurate information - tactical movement: more efficient, better spacing of troops
	- image capture & transmission	- OP: uncertain data can be passed on for interpretation

Figure 12: Characteristics of "Surveillance" and possible technological enhancements

5.2.4 Engagement

This is a generic term that includes all aspects of target acquisition and firing or discharging of all weapons. "Engagement" is an integral part of fire and movement. Five aspects can be proposed:

a) target assessment and acquisition,
b) aiming,

c) weapon firing,
d) terminal effect, and
e) damage assessment.

The principal problems lie in target identification (enemy rather than friendly or neutral), night fighting, collateral damage, obscuring vegetation and terminal effectiveness. Current tools comprise small arms and other tube launched weapons (eg Steyr, Minimi and Carl Gustaf), hand grenades, flares, smoke rounds and Claymores.

Physiological & psychological implications	Possible technology enhancements	Examples of enhanced activities
"Engagement" is of variable physical exertion, depending on the weapon delivery system & length of engagement, & requires much mental activity. Firing trauma may be a problem with some weapons.	- low light level night vision device	- attack: increased target identification & stand off ranges - ambush: increased target identification & stand off ranges - defend: increased target identification & stand off ranges - VCP: cover to exposed troops can be supplied from longer range
	- thermal sights	- attack: increased recognition & stand off ranges - ambush: increased recognition & stand off ranges - defend: increased recognition & stand off ranges - VCP: cover to exposed troops can be supplied from longer range
	- battlefield interrogation system	- attack: real time friendly troop identification - ambush: real time friendly troop or neutrals identification, - defend: real time friendly troop identification
	- remote aiming	- attack: less exposure to enemy fire - defend: less exposure to enemy fire
	- bursting rounds	- attack: less need for line of sight targeting - defend: less need for line of sight targeting

Figure 13: Characteristics of "Engagement" and possible technological enhancements

5.2.5 Protection

Fortification is an inherent part of defending a location. It usually requires hard manual labour if digging is required though effective concealment can be achieved through skilled use of vegetation or terrain. Apart from terrain and vegetation, weather conditions are the biggest influences on these actions. Two aspects can be considered:

a) concealment, and
b) solid defences.

During extended occupation of a single location it is likely that some form of defences will be constructed. These will include:

- use of existing buildings, terrain or vegetation
- construction of camouflage or use of camouflage nets
- barbed wire
- laying of Claymores & trip flares
- digging of gun pits, & construction of sandbag emplacements

For shorter actions, soldiers may rely upon concealment for protection or dig shallow "shell scrapes".

Physiological & psychological implications	**Possible technology enhancements**	**Examples of enhanced activities**
This can involve very physical effort, particularly in hot & humid conditions.	- effective heat stress management	- tactical movement: less heat casualties
	- thermal camouflage	- ambush: less risk of detection in the ambush site - defend: less risk of detection and targeting

Figure 14: Characteristics of "Protection" and possible technological enhancements

5.2.6 Movement

At some stage or other, infantry soldiers will be required to walk or move around the battlefield. This should not be seen as an automatic event, with little scope for improvement, since there are skills involved in correct movement to avoid detection by the enemy whilst remaining visible to blue forces. There are also obvious technology improvements that could be made, with for instance, boots and heavy loads being the principal sources of complaint for the soldier. Current movement skills are constrained by uniform and equipment.

Physiological & psychological implications	Possible technology enhancements	Examples of enhanced activities
The level of physical exertion will depend on the carried load (patrol or marching order), the going, slope, weather & vegetation. It could be very debilitating. High concentration may be required for uneven surfaces or night movement	- thermal camouflage	- patrol: reduces chance of detection, more effective patrolling - attack: reduces chance of detection: less blue casualties
	- more effective heat loss in uniforms	- patrol: less heat casualties, less likelihood of detection
	- more effective load carriage	- patrol: less discomfort or fatigue & thus better situational awareness, better detection ability - attack: lower restrictions on motion, less blue casualties

Figure 15: Characteristics of "Movement" and possible technological enhancements

6. Personal factors

Finally, and complementary to the section/platoon based activities, and individual core skills, several personal human factors should be considered. These are non-combat activities that are in effect extensions of the core skills list since they represent potential ways of adding value to the carrying out of the combat activities. They also represent a method of division of the non-combat aspects of the soldier's day and are complementary to the combat activities. On the basis of personal experience and observation, six were identified as follows.

Waiting: This is a non-combat activity that takes up a significant part of the soldier's day. It may be combined with "resting" though in general the action is part of a larger operation, and thus may be mentally intensive though needs little physical effort. It may be useful time if it allows the soldier to become mentally prepared for the next action.

Sleep: This is probably the most time consuming activity. Equipment for sleeping constitutes a major part of the carried equipment: mattress, sleeping bag, hoochee and mosquito net and this poses weight and bulk problems. Principal problems lie in the available length of time for sleep and night activities, with some soldiers having to sleep during daylight. Achievement of sufficient quality sleep is a perennial challenge for the infantry soldier and the commander.

Previously, an inflatable mattress was available but seldom used because of unreliability. Recently, lightweight and low bulk self-inflating mattresses have become available and these are commonly carried. This allows soldiers to sleep on very hard ground with insulation against the cold. This is an example of a seemingly trivial advance in a non-combat area but which is likely to have a profound value adding effect on capability.

Eating/drinking: Both eating and drinking pose logistic problems for the infantry section. Each soldier may require 8 L of water and 1.5 kg of food (including containers) per day. Cooking equipment adds to the total carried weight and bulk. Current tools include 1L water bottles, 2L skins, 1 man ration packs and a heating stove. It is neither mentally nor physically intensive though may be used as a form of relaxation. No heating of food is possible after dark with the current hexamine stove if blackout is required. Even use of the stove in a dug-out pit may still be visible to thermal sensors. There is also considerable extraneous packaging such as tins.

Rest: This is a non-specific time when the soldier is not doing anything else. It requires neither mental nor physical exertion and no additional equipment is used. Best use however is made of other equipment such as packs to lean on. The time may also be used to do routine tasks such as weapon cleaning. It is probably a major constituent of the soldier's day and the challenge is to make best use of the time to provide recuperation.

Personal Hygiene: This is an action that is critical to prevention of non-combat casualties. Soldiers shave and wash on a regular basis and this requires water and personal items that must be carried. Personal experience has shown that lack of access to a change of clothes or daily showering, as experienced in barracks or home based life, is not perceived as a problem in operational units. A routine of changed clothes and showers on a weekly to fortnightly basis is perceived as satisfactory to the troops. Nevertheless, soldiers in northern Australia may suffer from problems caused by tropical diseases, or fungal or invertebrate infestation.

These activities may be regarded as non-combat issues though relate to short and long term issues such as mental and physical fatigue, and general health and wellbeing. To some extent, they provide respite and recovery from the detrimental effects introduced through the combat activities. Effective management of these personal factors is one of the key challenges in leadership and soldier modernisation is no different. Unlike many of the other activities described in section 4, they are often not well represented by computer models. However, knowledge of how these factors interact with the other core skills and overall tasks is critical to longer term goals of more meaningful wargaming and modelling analysis, particularly when sustained operations are considered. There are significant deficiencies in the current wargaming models with regard to human factors. For instance, in CAEN, soldiers can sprint all through the operation, whilst in IUSS, heart rate does not increase during combat. Much work needs to be done for these wargaming models in order to include so called soft terms such as tiredness or morale.

Technology products have not been identified specifically for each factor though the following might be flagged:

a) ergogenic aids (eg chemicals to aid sleep during daytime or to enhance alertness),
b) better water retaining diets,
c) effective chemical insect repellents,
d) improved sleeping materiel, and
e) self heating meal packs.

7. Discussion

The nine combat activities proposed in this paper demand competency in a set of six core skills. Enhanced competence in these skills, through the insertion of technology or changes to procedure will lead to increased capability to conduct combat activities. An example is the intrasection radio that enhances the "communication" core skill, and consequently several of the combat activities. For instance, in a patrol, the use of radios allows greater spacing of the troops since visual hand signal distance no longer needs to be maintained; a greater area can be covered. In coordinated actions potentially involving fire and movement, such as attack, defence and occupation of harbours, radios allow much better situational awareness, particularly for the section or platoon commander. Thus actions are better coordinated and controlled, and will lead to lower blue force casualties. Finally, in an ambush, the radio allows very quiet communication between troops without the need for movement. The local commander is thus in better control and better balance is achieved between the need to obtain positive target identification and the layout for maximum killing effect. Other examples were noted in section 5. In general, each of the core skills applies to many of the combat activities, though the degree of influence and the potential gains differ.

This core skill/activity approach is superior to one based on a hierarchical progressive deconstruction into smaller components of each activity. This method would lead to an extensive list of actions, where aspects of specific skills would be noted in a very piecemeal and fragmented manner. The use of core skills serves to bring these items together in a far more rigorous and useful manner. This will also help identify any synergisms and antagonisms, since the core skills reach across several activities. To some extent this is a similar approach to the NATO SMP subsystems [1], since both group types of technologies, though the NATO terms are more outcome based. For instance, it is possible to equate the core skills "engagement" with subsystem "lethality" though other comparisons are harder to justify.

In addition, a series of five non-combat activities related to personal factors has been identified. Taken together, the combat activities and personal factors should be sufficient to identify the majority of "soldier's day" and have been successfully applied to a platoon analysed during KANGAROO 95 [2].

This paper lays the basis for the serials examined in the ITES [3] and later field experiments [7], for the operational situations used to develop the WUNDURRA concept for the Committee system, and for future work in analysis of section and platoon effectiveness. Each of the combat activities will be examined in more detail, using the following methodology:

a) functional deconstruction into phases,
b) mathematical description of the interrelations of each phase,
c) mathematical treatment of the core skills used,
d) selection of suitable analytical measures,
e) determination of suitable vignettes for modelling,
f) selection of appropriate models (including CAEN),
g) baseline modelling of current performance,
h) identification of likely technology enhancements,
i) modelling of enhanced red and blue military units, and
j) quantification of capability deficiencies and enhancements.

In this context, "baseline" refers to current blue (Australian) and red procedures and tools, "enhanced red" refers to likely improvements in regional capability achievable by 2005, and "enhanced blue" refers to possible improvements as a result of Project WUNDURRA, achieved by 2005. It is important to note that deficiencies should be measured against the enhanced and not the baseline red force. Studies have been made of the "attack", "ambush" and "defend" activities by CAEN [4,8], and "patrol" and "observation post" by modelling [9].

Finally, it is recognised that determination of specific measures of effectiveness is only the first step towards the systems methodology most appropriate for Project WUNDURRA. It is planned to develop this work further to determine appropriate measures of outcome for each activity and this would be achieved through a combination of the specific measures of effectiveness, within an envelope of role and local conditions. Similarly, the measures of outcome could be integrated to a give an indication of the overall measure of capability of the unit to conduct a range of tasks and this could be applied to the Army 21 dimensions of detect, respond and protect, or the NATO subsystems [1].

8. Conclusions

This work describes the generation of a series of nine activities, six core skills and five personal factors that can be used to delineate the actions of small units of dismounted soldiers (Table 3).

Doctrine has been used to determine a number of combat activities that adequately describe actions of the dismounted section or platoon. These have been characterised

in terms of phases of action, skills used, physiological and psychological consequences and demands, and possible analytical measures. These activities have been used to design a set of credible operational situations that were examined in the submissions supporting Project WUNDURRA to the committee system.

Table 3: Activities, core skills and personal factors identified in this work

Section or Platoon activity	core skill	personal factors
orders	communication	waiting
patrol	navigation	sleep
attack	surveillance	eating/drinking
ambush	engagement	rest
defend	protection	personal hygiene
vehicle check point	movement	
observation post		
tactical movement		
occupy harbour		

Whereas the nine activities are useful for modelling, and showing overall quantitative effects of changes of equipment or procedure, they are of less value in determining specific effects of technology insertion. An alternative approach was to describe a set of six core skills common to several activities. Thus the effect of technology or procedural enhancements could be mapped onto a range of activities, and areas for priority technology insertion identified.

A further series of personal factors was derived to account for the remainder of the "soldier's day" when no combat activities occurred. These factors may also be thought of as core skills, since they represent functions that could be improved either through training, changed procedure or technology insertion.

This work has greatly assisted in the development of a sound methodology in a previously immature area with the result that analysis of small dismounted units can now be attempted and useful results obtained. Finally, it is noted that in common with the evolutionary nature of Project WUNDURRA, the work presented in this paper will be subject to future testing and revision.

9. References

1. Curtis, NJ, *Possible Methodologies for Analysis of the Soldier Combat System* DSTO Technical Report DSTO-TR-0148, 1995

2. Curtis, NJ, Hobbs, WSR, and Principe, F, *Exercise KANGAROO 95 - Infantry Soldier Activity* DSTO Technical Report DSTO-TR-0000 (in vetting process)

3. Curtis, NJ, and Hobbs, WSR, *Report on Infantry Technology Evaluation Study 1995,* DSTO Report in preparation

4. Bowley, DK, and Millikan, J, *CAEN and JANUS Modelling of Ambush Scenarios,* DSTO Report in preparation

5. *Manual of Land Warfare Part Two Infantry Training Volume 1 Pamphlet No 1 The Infantry Battalion,* 1984, (RESTRICTED)

6. *Manual of Land Warfare Part Two Infantry Training Volume 1 Pamphlet No 1 The Rifle Company,* 1986, (RESTRICTED)

7. Bowley, DK, Curtis, NJ, and Hobbs, WSR, *Science and Technology Framework for Soldier Combat System Evaluation Studies,* DSTO Report DSTO-GD-0122, 1997 (RESTRICTED)

8. Bowley, DK, and Millikan, J, *Operational Analysis of the Attack, Defence and Ambush Operational Situations Combat Activities* Paper presented to 23rd meeting of QWG AOR, Canada, 1997

9. Hobbs, WSR *Section Surveillance Models* Paper presented to 23rd meeting of QWG AOR, Canada, 1997

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19. ABSTRACT

This paper describes the formulation of a list of activities that can be used in analysis of infantry operations. Company tasks have been used to derive nine distinct activities that may be carried out by infantry sections and platoons. These were characterised in terms of the separate phases, skills and tools required, physiological and psychological intensity and proposed analytical measures. Six core skills were identified that are common to several activities. Personal factors related to non-combat time were also determined. Taken in total, the personal factors, and the section and platoon activities are sufficient to categorise the "soldier's day". The work supports soldier modernisation studies as part of Project WUNDURRA.

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